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Designation: Method and device for the detection, recording and counting of mechanical defects on continuous bands, for example, films.

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Patent Claims

1. Method and device for the detection, recording and counting of mechanical defects on continuous bands, for example, films, which is characterized by out-of-contact scanning using infrared light and by the ability to clearly detect the position of the defect in the vertical direction and its extent in the horizontal direction such that neither the content of the photographic image on the film nor the ambient illumination has any effect on the measurement result, and further by the possibility of using the scanning device in conjunction with a counter or as a warning device in film processing machines.

2. Device for performing the method according to Claim 1 and characterized by the ability to achieve continuous recording of the defects through attachment to a multi-channel recorder.

3. Device for performing the method according to Claim 1 and characterized by a switching device which permits the operation in conjunction with a single-channel strip recorder.

4. Device for performing the method according to Claim 1 and characterized by the attachment of a counter which indicates the number of defects per unit length and thereby allows an assessment of the mechanical quality of the scanned band/film.

5. Device for monitoring according to Claim 1 and characterized by inserting the scanning device into the band/film path of processing machines, scanning of same and triggering of an alarm signal as soon as defects are detected.

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ORIGINAL INSPECTED

Method and device for the detection, recording and counting of mechanical defects on continuous bands, for example, films.

Description

The subject of the invention is a method and a device for its use in order to perform out-of-contact scanning, via infra-red light, of continuous bands, for example, films, in order to detect, localize and record or count mechanical defects on same.

Mechanical defects that can be detected, recorded or counted with the aid of the method described include: perforation defects, vertical, lengthwise and diagonal scratches, bands/films that have been damaged by the teeth of the transport rolls, scratched in the pattern of these rolls, or severely deformed bands/films.

During processing and projection of films, for example, these are always at risk of becoming so severely damaged due to mechanical causes that further processing or further use is impractical. In order to detect such defects, the Applicant is aware, at this time, of three methods.

Visual Checking,
Drawbacks: This is costly in time and the record of the mechanical condition of the film is subjective.

Mechanical scanning of films via sapphire-tipped sensors,
Drawbacks: There is a great danger of an additional defects due to mechanical scanning. Applicant is unaware of a method for counting or registering of defects.

Out-of-contact scanning of a film by an optical system driven by mechanical means so as to scan the film row by row. Described in "Bild und Ton", Issue 7/1973, VEB Fotokinoverlag, DDR WP 86 512.

Drawbacks: Costly mechanism. The content of the photographic image on the film alters the measuring result, slow processing speed of the film material to be checked. Mechanical counters can capture

merely the number of defects, but not their position on the film.

This invention is based on the requirement to avoid the above-named drawbacks and to protect the film to be examined via out-of-contact scanning and to establish, by means of a strip chart recorder attached to the device, a record that is reproducible at any time. It furthermore permits to read out the position of the defect in the vertical direction and its extent in the horizontal direction. In addition, the film to be checked can be run through at a faster rate compared with the methods known to-date, and through the comparison with previous records, newly developed defects can be identified.

The method according to the invention is based on mounting several commercially available reflective object sensors either above each other, or adjacent to each other in an offset arrangement. The film that is advanced via the sprocket wheels 2, with the edges of the film guided by glide rails 3, is passed continuously in front of a dull-black screen 4 and past the reflective object sensors. A steel plate with slots for the passage of light rays is mounted in front of these [sensors] in order to protect the front of the reflective object sensor against damage during the insertion of the film. The reflective object sensor consists of a light diode which is located together with a photo-transistor in a common housing. The inlet and outlet openings are protected by infra-red transparent filters, so that neither the ambient illumination nor the content of the photographic image will have an influence on the result of the measurement. Due to the fact that an undamaged film possesses a different reflexivity than a damaged film, a voltage differential is developed at the output. Upon successful amplification, the signal from the array of reflective object sensors is routed to the corresponding channels of a multi-channel recorder. In the ideal case, the paper advance is driven by the drive of the take-up mechanism so that the speed of film passage is proportional to the rate of paper advance. In the case of a recorder with integral drive, this is to be coupled to the switch of the take-up mechanism. In this way it is possible to localize the defect precisely in the vertical direction and its extent in the horizontal direction.

The fact that mechanical defects of bands/films in the horizontal direction always extend over several length units permits the design of a simplified version with a single-channel chart recorder. A reflective object sensor, mounted in addition, scans the perforation of the film as it passes by. The impulses

obtained and processed in this manner serve to control an electronic switch. The latter directs, in selectable time intervals, the outputs of the reflective object sensors sequentially to the input of the chart recorder. The information from the individual reflective object sensors is superimposed to a DC voltage of different levels such that both the position and the extent of the defect can be identified unambiguously on the recorder strip.

Additionally, a combination of the scanning device and a digital counter permits the sum total of defects per length unit to be captured. The numerical value obtained in this manner allows a determination as to the mechanical quality of the film.

An array of several reflective object sensors mounted one above each other, in connection with an amplifier, a relay and an adder can serve as a warning device. This arrangement provides protection when installed at several locations in the film path of a film development machine, or also installed in copying machines, because the radiation of the reflective object sensor is in the infra-red part of the spectrum and the raw film is consequently not exposed. It warns in the event of passage of defective films so that the machine can be shut down and the problem can be corrected before a greater quantity of firm material has been damaged.

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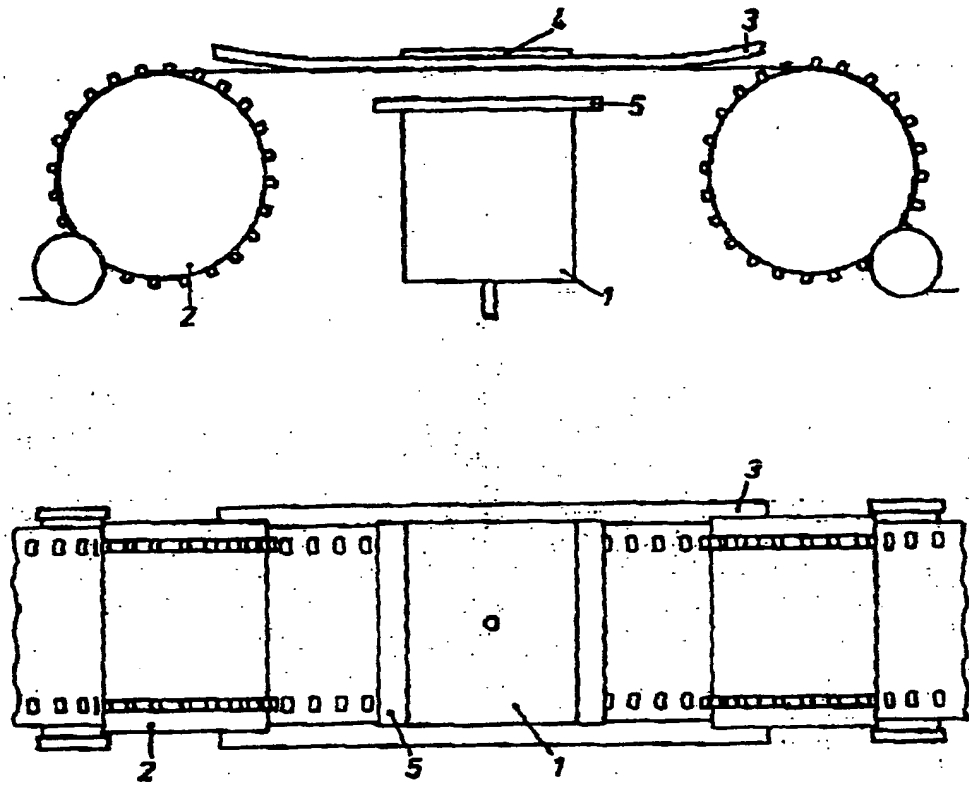

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